SECTION C Descriptions and Specifications

I. INTRODUCTION

The contractor shall perform task assignments in support of Carderock Division, Naval Surface Warfare Center (NSWCCD) projects in the areas of ship acoustics, sonar data collection systems, sonar calibration, sonar performance, sonar self-noise, acoustic signal processing, acoustic systems development, acoustic signature reduction R&D, and at-sea experimental test & evaluation design support. These projects will be directed toward Navy program goals in sonar systems, acoustic data collection systems, ship signature characterization, full scale and model scale ship signature measurements, and acoustic sensor/systems development supporting related programs such as TUBA, ACINT, SASMP, LSV, ISMS, IMAT, LCC and other signature measurement programs. TUBA includes the following systems and their associated support equipment: AN/BQH-5(V) series, AN/BQH9(V) series, AN/BQH-10(V), AN/BQH-11(V) series, ERDS, and the Calibration (CAL) Processor and all follow-on TUBA Data Processing Systems.

The contractor will provide the personnel, material, and facilities necessary to accomplish task assignments within the task areas generally described in this Scope of Work. These efforts will be implemented through the issuance of written assignments described in Task orders (Completion Contract). NSWCCD, through the Contracting Officer's Representative (COR), will provide the GFI/GFE/GFM technical data, and Government Furnished Equipment (GFE) necessary for task performance and will provide information on ship schedules for those tasks requiring visits to fleet units. A list of GFE/GFI/GFM will be provided with each individual Task order. The work to be performed under this contract is applicable to both surface ships and submarines.

*Note: List of Definitions are contained on page 8.

II. SCOPE

Specific work areas are as follows:

TASK AREA 1. Operational Trials Design, Sonar Signature Collection, Analysis and Reporting.

The contractor shall provide trial design engineering and analysis services for special experimental programs, submarine signature trials, and standard Sonar calibration exercises which involve both acoustic and non-acoustic measurements in support of the mission. In support of special programs the contractor may be required to support TUBA trials including data reduction on TUBA, CAL Processor, EMAP, TPEAS or future TUBA Data Reduction Systems, and HAYES and SEAFAC system certification R&D trials; support integrated radiated noise target strength, and related trials, some of which use a combination of HAYES HGA, Low Frequency Target Strength System (LFTS), and the Target Strength Measurement Systems (TSMS) in the same trial period. The engineering and analysis efforts shall include the evaluation of HGA trial data to develop more efficient ways of utilizing the full system capacity during reduced duration trials. Production of draft trials plans, incorporation of Fleet safety and NSWCCD operational guidelines, and accepted

statistical design techniques for at-sea scenarios and installation planning, will be required. The contractor shall also be required to participate in at-sea experiments in the areas of signature collection, data reduction and data management, special trials engineering, ILS support of trials equipment including recommendations for methods of equipment installation acceptable to Fleet Commanders, and providing pre-trial planning for HGA and Target Strength system trials to accomplish more efficient resource utilization. The contractor shall assist NSWCCD personnel in the design and execution of at-sea experiments for the purposes of acoustic and non-acoustic data collection. The contractor shall assist in the planning of tow tracks, submarine tracks, sensor design, manufacture and placement, projector levels and signal type, and pre-assessments of acoustic, non-acoustic and environmental conditions expected to influence the system/test. The contractor shall also furnish personnel to participate in the data collection experiments. These personnel shall provide at-sea data and model analysis support and perform general purpose functions such as the installation and removal of sea test hardware; the operation of tape recorders, sonobuoy receivers, filters, amplifiers, spectrum analyzers and other monitoring and recording equipment; and also maintain data log sheets. To support this task area, the contractor shall be responsible for all necessary logistics, such as providing any necessary special sensors and instrumentation, equipment and expendables/consumables, shipping and handling to support these data collection experiments. The contractor shall accomplish special engineering investigations for NSWCCD acquired data, including real-time spectral processing and data summarization suitable for direct publications. The contractor shall prepare technical presentations and instructive material to serve as guidance to NSWCCD and the Signatures technical community in the data reduction, data processing, and analysis of specialized sonar data. These presentations/materials shall emphasize the technical explanation of system processing characteristics associated with the collection sensors, and shall specify system induced statistical variations of the data. System dependent techniques for the incorporation of low signal-to-noise ratio data in the processed data base shall be analyzed. Procedures to specify the extent of sensor self-noise in data fluctuations shall be incorporated. The contractor shall prepare and/or update operator and user manuals and Interactive Electronic Technical Manuals (IETM) for selected data collection equipment, data reduction/analysis equipment, and sensor system equipment operating in a data gathering mode. Manuals shall encompass system operation, system deployment, system monitoring and system operations employment. Furthermore, the manuals shall specify organizational and operational requirements for data collection, a review of collection directives, and new signature processing requirements and modifications required by the introduction of new systems and/or components. The contractor shall also provide ILS support on selected signature acquisition equipment. The task efforts shall be documented in technical reports and trials summaries.

TASK AREA 2. NSWCCD In-House Signal Processing Support

The contractor shall perform signal processing related to program efforts, including: preparation of ADAC data reduction requests from ADADS, SDI, and/or shipboard logs; operation and maintenance of SoSAS and follow-on TUBA data processing systems (e.g., CAL Processor, EMAP, TPEAS), PTP, ADAS, and related systems; monitoring data flow and quality; performing initial file set-up for post reduction; and data analysis, review, and editing, and database updating and maintenance. The contractor shall provide sonar

measurement products such as Le, sonar sensitivity, SPL, NDI, and shall prepare final tabular summaries and graphical outputs. In addition, the contractor shall perform data averages from data generated in ADAC and make data comparisons to satisfy reporting requirements. The contractor shall also provide operational and maintenance support to the systems at NSWCCD which are used for post-trial analysis, including the Data Management System (DMS), the Analyst View Station (AVS), PTP and the MAX Analyst Terminal (MAT). In addition, the contractor shall provide operational and maintenance support to the NSWCCD in-house systems that provide post-test processing capability for ISMS data.

TASK AREA 3. NSWCCD Signal Processing Support

The contractor shall design, implement, upgrade, and support systems for post-trial processing including ADAS, SoSAS and follow-on TUBA Data Processing systems, HGA, PTP, EMAP, MAX, DMS, AVS, MAT, ISMS post-test processing and related systems. System changes shall be developed, tested, and installed to: expand capabilities; to remain compatible with sonar data gathering systems; or as requested by system users and approved by NSWCCD System Managers. The contractor shall provide changes to existing program documentation and deliver concurrent with system integration. Documentation shall follow accepted standards and include usage and operation instructions. The contractor shall also provide engineering support for NSWCCD’s data acquisition and processing systems. The maintenance shall include the ADAS, SoSAS and follow-on TUBA Data Processing systems, PTP, desktop automated systems, tape recorders, disk drives and analyzers, and other measurement/storage instrumentation. Also, engineering support will be required in the areas of operational checkout, corrective and preventative maintenance, calibration, and system documentation.

TASK AREA 4. On Board Sonar System and Acoustic System Support

The contractor shall design and implement specialized analysis algorithms and databases for customized on-board sonar processing equipment and on-board signature monitoring systems to perform selected measurements and data collection. Systems to be incorporated will include automatic controllers associated with AN/BQH-5(V), AN/BQH-9(V), AN/BQH-10(V), AN/BQH-11(V), AN/BQQ-5, AN/BQQ-10, and AN/BSY-1/2 sonar systems and shall include such systems as TOPS and EMAP, TPEAS and future TUBA on-board data processing systems; special purpose measurement equipment such as BATTPHONE; all HAYES and SEAFAC processing and analysis subsystems, including the HGA beamformer, BARB, and ARMS II tracking systems, TOMS, HOSS, AVS, MAX, DMS, D&D workstation and Transient Processor; as well as related shipboard measurement systems, including SARS and SSNFS. The subsystems will be interfaced to data gathering systems such as AN/BQH-9(V) or other TUBA data collection systems, and/or Platform Sonar Systems, and will monitor data during sonar grooms, calibrations, and other acoustic trials. System development shall be performed to enhance acquisition, execution, and processing time dictated by the introduction of additional sonar systems or to meet special objectives. Where applicable, each development will follow the NSWCCD Configuration Management Plans. All system expansions, modifications, and changes are to be documented in accordance with established reporting procedures. The contractor shall provide engineering support for NSWCCD’s data acquisition and processing systems in the areas of operational checkout, corrective and preventative maintenance, calibration, and system documentation. Included are EMAP, TOPS, HGA, HAYES telemetry and beamformer data coupling (BDC) systems,

LFTS arrays and telemetry systems, ODAS II, LSV, SARS, SSNFS, and Radiated Noise Measurement Ranging and Tracking Systems. The contractor shall also be required to design, develop, build, and assemble or modify data processing equipment, special cards, or DSP codes required to meet trial objectives.

TASK AREA 5. Measurement System Modeling, Performance Prediction and Data Collection Support

The contractor shall perform engineering analyses involving modeling and systems performance prediction for Navy sonars using advanced digital and electronic sonar interface modeling techniques. The analyses shall involve simulation of various improvements to current AN/BQQ-5 series SA/TA, AN/BSY-1/2 SA/TA/HA, AN/BQG-5, and AN/BQQ-10 sonars and the AN/BQH-9(V), HFA, STA, other TUBA systems, and signature monitoring systems. A complete array/processor performance prediction model shall also be developed and exercised for an evaluation of processor self-noise degradation. EDM test results, as well as at-sea test data, shall be incorporated into these models. Advanced sonar configurations, including AN/BQQ-10 and future sonar configurations, and measurement systems such as the HGA, shall be analyzed, and specific simulations, which provide information on the application of these concepts to program objectives, shall be performed. The contractor shall conduct analyses of HGA measurements to assess noise gain, signature measurement accuracy, and operational performance in shallow and deep water environments. In all cases, simulations shall employ performance models which explicitly account for electronic interfaces and control aspects of modern sonar systems. The contractor shall also provide scientific and technical analyses for several high frequency sonar system developments and assessment efforts using advanced sonar simulation, self-noise evaluation, and signal processing techniques. High frequency sensor concepts shall be considered, and the analyses shall address technical issues relative to the application of the concepts for high frequency data collection. The issues shall include self-noise, design tradeoffs, and groom/calibration procedure modifications for assessing the impact of these sonar programs on the data collection functions, and shall be documented with technical reports.

TASK AREA 6. Algorithms and Numerical Modeling

The Contractor shall be responsible for analyzing, developing, updating, implementing, and maintaining numerical algorithms for acoustic and non-acoustic prediction systems, processors, and trainers. This task area also includes analysis and assessment of AN/BQQ-10 A-RCI APB algorithms. Analysis and implementation shall include a recommendation for the best algorithms for specific uses. Algorithms, databases and models shall be implemented for specific scenarios that can apply to either prediction systems, processors, sonar systems, or trainers. Analysis also includes model/data comparisons, and identification and classification of model and/or data deficiencies. Development may include, but is not limited to, passive and active localization, tracking, classification, signal processing, propagation loss, sound pressure level and target strength computation, transmission path loss, probability of detection, signal synthesis, and beamforming. Algorithms and models will also require software maintenance and upgrades for transportability between platforms, for tactical and training displays, for access to new data bases, and for modeling new sensor characteristics.

TASK AREA 7. Future Data Acquisition and Measurement System Design Analyses and New Systems Development

The contractor shall perform detailed design analyses of future data acquisition and/or measurement systems, methods, and geometries required for new generation submarines such as SEAWOLF and VIRGINIA, as well as DD-21 and other surface ships. Analysis and prediction of measurement system performance for VIRGINIA R&D measurements and VIRGINIA trials will be required. Other areas of study will determine alternative methods for routine signature monitoring using onboard systems and methods for further refining target strength measurement, source characterization, and non-acoustic signatures. The contractor shall also perform detailed analyses of planned new data acquisition systems to assess the impact of such on the requirements for processing and analyzing the resulting data at NSWCCD signature processing facilities. The introduction of new signature acquisition systems employing advanced technologies and new sonar sensor arrays, hydrophone arrays, and telemetry systems, as well as new measurement approaches and new processing/analysis techniques, shall also be studied. The contractor shall use the results of these studies to provide recommendations for upgrading and/or modernizing current facilities and equipment. The results of each study effort shall be documented in a final report. Based on design analyses and studies, the contractor shall be required to develop new radiated noise measurement systems; advanced signal processing systems; Information Technology (IT) systems; and mass data storage, retrieval and analysis systems; structureborne noise and sonar self noise measurement, acquisition, and processing systems in support of Signature Directorate Programs.

TASK AREA 8. Program Management Support

The contractor shall perform scientific and engineering analyses for long term Navy development programs. The analyses will involve combining the disciplines of underwater acoustics, undersea warfare, acoustic propagation, signature data collection, submarine quieting, RCS measurement & reduction, and navy acoustic system development to support NSWCCD participation in current and future signature measurement programs. Analyze and review program areas including planning for advanced transient experimentation, developing POA&M and ILS planning, and support for HAYES HGA and LFTS. Results shall be incorporated into both planning and analysis functions for NSWCCD in each long term project area. The contractor shall provide liaison and progress monitoring of NSWCCD programs through attendance at program design and progress reviews, Engineering Development Model installations, and at-sea test planning conferences. Participation in overall program reviews shall also be required during stages from equipment formulation and validation of new concepts, through engineering design and development, test and evaluation, production, deployment, operations and final disposition of equipment being replaced. Task tracking, status of efforts toward accomplishments of milestones, and overall program feedback shall be provided via periodic status reports and trip reports.

III. CONTRACT MANAGEMENT

The Contractor shall maintain a management structure and management reporting system which will ensure proper and timely performance, delivery, and completion of all contract requirements and individual task requirements. The Contractor shall appoint a Program Manager to act as the focal point for

all communications between the Contractor and Government. The Program manager shall have overall responsibility for accomplishing the efforts ordered under individual Task orders.

The Government may schedule program and technical review meetings to review program and Task order status, and to discuss emergent problems. The contractor shall provide personnel and technical data to support these meetings, and maintain records of the proceedings.

IV. PLACE OF PERFORMANCE

The principal place of performance shall be at the Contractor's facility and/or NSWCCD facilities as specified in Task Orders. Travel may be required to various US Navy ships, shipyards, and Government and Contractor facilities. Travel requirements shall be stated in the Task Orders.

V. DELIVERABLES

The Contractor shall provide a monthly progress and financial status report in accordance with DD Form 1423 CDRL Item A001.

Technical reports and conclusions reflecting the work accomplished under each task set forth in individual Task orders shall be prepared and delivered in accordance with DD Form 1423 CDRL Item A002, and as specified in individual Task orders.

LIST OF DEFINITIONS

ACINT – Acoustic Intelligence
ADAC - Acoustic Data Analysis Center
ADAS - Acoustic Data Analysis System
ADADS - Advanced Digital Auxiliary Data System
AMFIP – Acoustic Measurement Facilities Improvement Program
ARMS - Acoustic Range Measurement System
ATAMS - AMFIP Towed Array Measurement System
ATAMS-NAP - ATAMS Navigation Assistance Program
AVS - Analyst View Station
BARB - Bearing and Range Box
BATTPHONE - Battery operated Hydrophone
BDC - Beamformer Data Coupling
COR – Contracting Officer's Representative
D&D - Detection & Detectability
DMS - Data Measurement System
DSP - Digital Signal Processing
EDM - Engineering Design Model
EMAP - External Monitor And Processor
ERDS - Element Recording Data System
GFE - Government Furnished Equipment
GFI - Government Furnished Information
GFM - Government Furnished Material
HA - Hull Array
HGA - High Gain Array
HFA – High Frequency Array
HOSS - HGA Operator Super Station
IETM – Interactive Electronic Technical Manual
ILS - Integrated Logistic support
IMAT – Interactive Multi-sensor Analysis Trainer
ISMS – Intermediate Scale Measurement System
Le -Sonar self-noise
LFTS - Low Frequency Target Strength System
IT – Information Technology
IMAT - MAX Analyst Terminal
MAT – MAX Analyst Terminal
MAX - MNNAS Extension
MNNAS – Multichannel Narrowband Measurement Analysis System
NSWCCD - Carderock Division, Naval Surface Warfare Center
NDI - Directivity Index
ODAS – Onboard Data Acquisition System
ONI - Office of Naval Intelligence
PTP - Post Trial Processor
R&D - Research & Development
RCS - Radar Cross Section
SA - Spherical Array
SARS – Structureborne Noise Analysis and Recording System
SASMP – Submarine Acoustic Silencing Maintenance Program
SDI - Support Data Interface
SEAFAC – Southeast Alaska Facility
SEAWOLF - Nuclear Submarine Class
SoSAS - Sonar Signal Analysis System
SPL - Sound Pressure Level
SSN - Nuclear Attack Submarine
SSNFS – Sonar Self Noise Field System

STA - Special Towed Array
TA - Towed Array
TOMS - Third Octave Monitoring System
TOPS - TUBA On-Line Processing System
TSMS - Target Strength Measurement System
VIRGINIA – Nuclear Submarine Class